San José State University
College of Engineering, Electrical Engineering Department
EE-231, Automatic Control Theory, Sec 02, Fall, 2017

Course and Contact Information

Instructor:	Mohamed Badawy
Office Location:	ENG-361
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Office Hours:	Mondays & Wednesdays: 3 pm – 4:30 pm
Class Days/Time:	Mondays & Wednesdays: 6 pm – 7:15 pm
Classroom:	MacQuarrie Hall 423
Prerequisites:	Graduate Standing

Course Format

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on Canvas Leaning Management System course login website at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through MySJSU at http://my.sjsu.edu to learn of any updates.

Course Description

This course teaches the fundamentals of state space techniques in the analysis and synthesis of dynamic control systems; relationship to classical control theory. Useful state space forms are introduced in this course to analyze the system controllability, observability, etc. Modern control theories are applied on physically modeled systems to validate the theories effectiveness for a wide variety of applications. Finally, an introduction into optimal control is studied in this course.

Course Goals

To provide the needed theoretical and practical knowledge to the electrical engineering graduate students in the area of control systems.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Model simple physical systems (thermal, electromechanical, etc..) by differential equations, S-domain block diagrams, or state variable equations.
2. Analyze a linear system described by transfer functions or state equation for their time and frequency domain characteristics such as time constant, overshoot, damping, pole locations, frequency response, and stability.
3. Design compensators to achieve certain engineering specifications.

4. Analyze the various properties of state space representations, such as controllability, reachability, observability, stabilizability, and detectability.
5. Apply modern control techniques for a linear time-invariant system including state variable feedback, output feedback, state estimator (observer) design, decoupling control, and optimal control using software simulation tools.

Required Texts/Readings

- Class notes/handouts.
- "Modern Control Engineering", authored by Katsuhiko Ogata. Latest Edition.

Other Readings

- "Feedback Control of Dynamic Systems", authored by Franklin, Powell, and Emami-Naeini.Addison Wesley. 6th or 7th Edition.
- "Control System Design: An Introduction to State Space Methods", authored by Bernard Friedland, McGraw-Hill, most recent edition.
- "Modern Control Theory", authored by William L. Brogan, most recent edition.

Other technology requirements / equipment / material

- Matlab/Simulink is needed for the homework assignments. The software is available in the Engineering labs, however, the students are encouraged to get their own educational copy.

Course Requirements and Assignments

- There will be one In-class midterm and one final exam (take home and an In-class quiz) for this course.
- There will be one project of the course where the students will apply the learned theories on a system of their choice using simulation software tools. The students will present their work on the project during the class time as shown in the course schedule.
- Five homework assignments will be given in this course, but only the best five for every student will be graded.

Grading Information

Final Exam	30 %
Project	25 %
Homework	25 %
Midterm	20 %

Determination of Grades

>96%	A+
>92%	A
>88%	A-
>84%	B+
>80%	B
>76%	B-
>72%	C+
>68%	C
>64%	C-

>60%	D+
>56%	D
>52%	D-
<48%	F

There will be extra credit for class interaction, and for some special assignments.

Late assignment will be credited up to 50% of the full assignment credit (late assignments are accepted up to 48 hours after the assignment due).

Classroom Protocol

Students are encouraged to attend the class on time. Interaction in the classroom between the students and the instructor or between the students and their peers (while solving problems) is highly encouraged.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

EE-231 / Automatic Control Theory, Fall 2017, Course Schedule

Course Schedule (The class pace and the content are subject to change during the semester with a fair notice)

Week	Date	Topics, Readings, Assignments, Deadlines
1	Wednesday 08/23/2017	Introduction to Control Systems
2	Monday 08/28/2017	System Modeling in the Frequency Domain
2	Wednesday 08/30/2017	Control Systems Time Response and Steady State Errors
3	Monday 09/04/2017	Labor Day – No class
3	Wednesday* 09/06/2017	Root Locus Sketching
4	Monday 09/11/2017	Controller Design Using Root Locus
4	Wednesday 09/13/2017	Controller Design Using Bode Plot
5	Monday 09/18/2017	State Space Representation
5	Wednesday 09/20/2017	Linear Algebra

Week	Date	Topics, Readings, Assignments, Deadlines
6	Monday 09/25/2017	Solution of the State and Output Equations
6	Wednesday* 09/27/2017	Controllability, Observability & Canonical Forms
7	Monday 10/02/2017	• No in-class lectures this week • Will be replaced with either online lectures or other agreed upon times for in-class lectures.
7	Wednesday 10/04/2017	
8	Monday 10/09/2017	State Feedback Control
8	Wednesday 10/11/2017	State Feedback Control with Reference Input
8	Friday 10/14/2017	State Feedback Control with Reference Input and an integrator
9	Monday 10/16/2017	State Space Observers
9	Wednesday* 10/18/2017	State Space Observers with State Feedback
10	Monday 10/23/2017	Reduced State Observers
10	Wednesday 10/25/2017	
11	Monday 10/30/2017	Projects Assigned to the Students Midterm Exam
11	Wednesday 11/01/2017	Control Law and Estimator Examples
12	Monday 11/06/2017	Reduced State Observer Example
12	Wednesday 11/08/2017	Reference Input + State Feedback + Observers
13	Monday 11/13/2017	
13	Wednesday* 11/15/2017	Minimum Realization of MIMO Systems
14	Monday 11/20/2017	Introduction to Optimal Control

Week	Date	Topics, Readings, Assignments, Deadlines
14	Wednesday 11/22/2017	Thanksgiving break – No class
15	Monday* 11/27/2017	Linear Quadratic Regulators
15	Wednesday 11/29/2017	Students Project Presentations
16	Monday 12/04/2017	Students Project Presentations
16	Wednesday** 12/06/2017	Students Project Presentations
17	Monday** 12/11/2017	No in-class lecture / will be replaced with an online revision lecture
Final Exam	Wednesday 12/13/2017	Final Exam at 17:15 pm Project Reports Due

* A HW is assigned
** The take home portion of the exam is assigned to the students